CLAIMS

1. Apparatus for the production and detection of fluorescence at or below a surface, said apparatus comprising:

a light source for directing fluorescence excitation light along a light path extending over a said surface;

a reflector having a three dimensionally curved, shell-like light reflecting interface positioned to receive light from the light source passing over said surface along a portion of said light path and to reflect said light transversely with respect to said portion of the light path so as to focus said light on an illumination zone at or below said surface for stimulation of fluorescence at said zone, and to collect fluorescence light emitted at said zone and to reflect and at least partially collimate said light to pass back along said portion of the light path; and

a detector for receiving said light emitted as fluorescence after reflection at said interface.

2. Apparatus as claimed in Claim 1, further comprising a beam splitter reflecting light emitted by said light source to pass to said reflector and receiving fluorescence light from said reflector and passing said fluorescence light to said detector.

3. Apparatus as claimed in Claim 2, wherein said reflector, light source and detector are arranged in a

generally coplanar manner and said beam splitter has a planar reflective interface that lies in a plane orthogonal to the co-planarity of the reflector, light source and detector.

4. Apparatus as claimed in any preceding claim, further comprising an excitation filter selecting an excitation wavelength from the light emitted by the light source to pass to said reflector.

5. Apparatus as claimed in any preceding claim, further comprising an emission filter selecting an emitted fluorescence wavelength to pass to said detector.

6. Apparatus as claimed in any preceding claim, comprising a lens or a second reflector focussing fluorescence light on said detector.

7. Apparatus as claimed in any preceding claim, wherein said reflector interface substantially has the form of a partial paraboloid, aspheric, toroidal, or biconic surface.

8. Apparatus as claimed in Claim 7, wherein said reflector interface is defined by an equation

$$Z = \frac{cr^2}{1+\sqrt{1-(1+k)c^2r^2}}$$

wherein:

c is from 0.07 to 0.5 and k is from -1.5 to -0.7, where z is the "sag" of z-coordinate along the rotational axis, c is the curvature(the reciprocal of the radius

R), k is the conical constant and r is the radial coordinate.

9. Apparatus as claimed in Claim 7 or Claim 8, wherein said reflector interface includes that part of a paraboloid, aspheric, toroidal, or biconic surface that is generated by the cutting of a paraboloid, aspheric, toroidal, or biconic surface by a right circular cylinder erected centred on the illumination zone.

10. Apparatus as claimed in Claim 7 or Claim 8, wherein said reflector interface substantially has the form of a part of a half paraboloid.

11. Apparatus as claimed in any preceding claim, further including a housing containing the light source, reflector and detector and having a base surface containing a window for passing excitation light out of the housing and receiving fluorescence light into the housing and being for engagement in use against the said surface at or below which said fluorescence occurs.

12. Apparatus as claimed in any preceding claim, wherein said light path makes an angle of no more than 10 degrees with a plane defined by said base surface.